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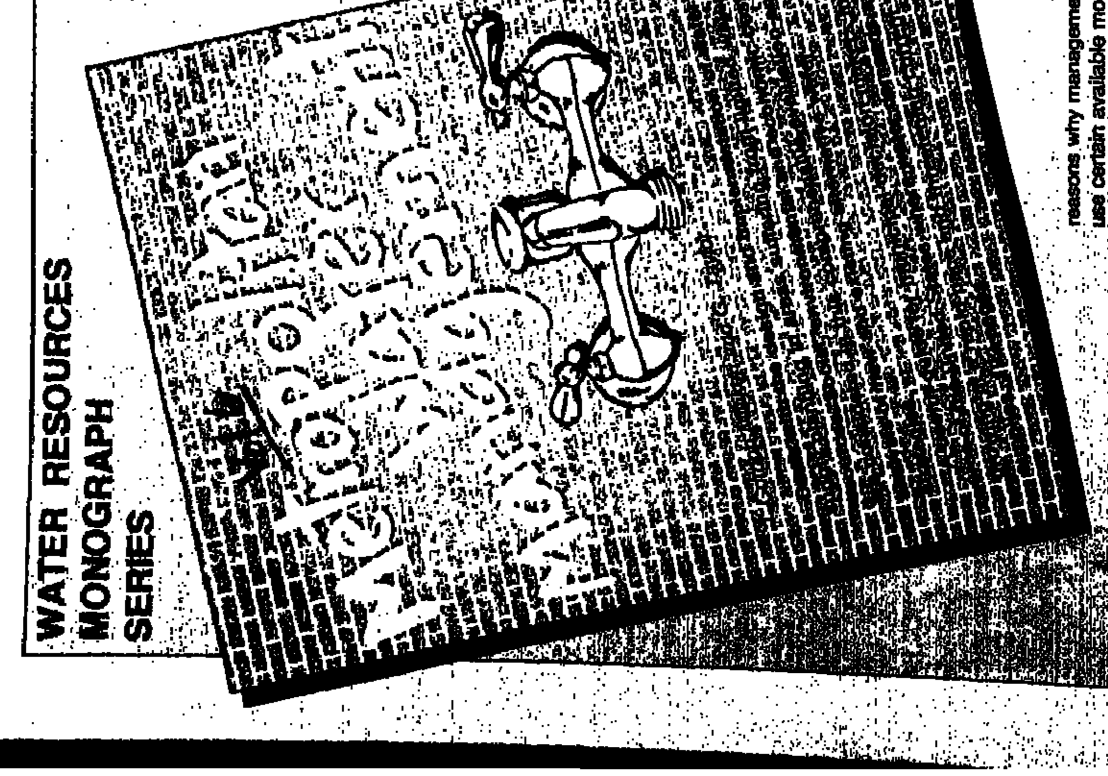

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Editorial

An Atmospheric Sciences Section

It has been proposed that the name of the Meteorology Section be changed to 'Atmospheric Sciences Section.' Such a change would emphasize the interdisciplinary nature of the scientific interests pursued by AGU members. It would encourage atmospheric chemists and atmospheric electricians to affiliate with the section.

There is also considerable interest in combining this section with certain portions of SPR: Aeronomy. Some aeronomers have shown interest in joining Atmospheric Sciences and some want to stay in SPR.

Unfortunately, there are few convenient ways to explore the opinions of the entire membership of both sections regarding the proposed change other than this editorial in Eos. We urge you to voice your suggestions or comments by October 1981 to your section president or president-elect. Is the name change appropriate? Is such a merger with parts of SPR: Aeronomy reasonable? If this is done how would one determine what parts of Aeronomy should join Atmospheric Sciences and what parts should stay in SPR?

We also plan to have business meetings of the Meteorology Section and the SPR Section at the Fall Meeting of the AGU to consider this matter further.

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Cover. Beam plasma discharge: (left) A 25 mA, 1.8 keV electron beam injected at 50° pitch angle in a magnetic field of 1.5 gauss and a neutral gas pressure of 8×10^{-6} torr. (right) All conditions same except current increased to 60 mA. What was formerly individual particle Larmor motion (left) has ignited into a strong luminous ionization column filling the Larmor spiral (right). Collective action of the beam and its self-made plasma in producing intense electric waves which accelerate electrons and ionize the neutral gas is responsible. (Photo by Hugh Anderson and Jerry Jost at the NASA Johnson Space Center Vacuum Test Facility; camera exposure about 1 min at f:2.8 using ASA 3000 film. See meeting report, pg. 678, for more information.)

A Former Editor Views the Editorial Process

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Introduction

It was at the AGU Fall Meeting in San Francisco in December 1976, shortly after my appointment as coeditor of *Water Resources Research* that I first began to realize the strong emotional ties that exist between a scientific community and its journals. Feelings run high, regardless of whether they come from readers, contributors, reviewers, active scientists, or scientific administrators. Opinions are often positive, sometimes negative, usually a mixture of the two; but regardless of their tenor they are delivered to the editor, in person, usually fortissimo. From that day until this, conference life has never been dull. When I meet a colleague in the halls there is never a loss for words, no need to search for a topic of mutual interest; WRR is always there at the ready.

Over these years I have listened to suggestions, compliments, opinions, proposals, questions, complaints, secrets, and curses. But when stripped of the specifics, most of my colleagues were asking a variant of one of the following seven questions:

1. Why did it take so long for my paper to appear?
2. How could you possibly have rejected my recent submission (especially in light of the enthusiastic support of reviewer D and the obvious incompetence of reviewers A, B, and C)?
3. How could you possibly have accepted the paper by Smith and Jones (especially after the scathing review I sent you)?
4. What is the policy of WRR toward multiple-part papers?
5. What is AGU's page charge policy with respect to WRR?
6. Why does WRR publish so many theoretical papers and so few applied papers?
7. Is the review process really needed at all?

I am writing this article in the hope that it will provide some answers to these questions and that it may help to clarify the murky workings of the editorial process. Of course, as with all clarifications, there is a hitch. My term as editor expired on January 1, 1981, and philosophies of editing are notoriously personal. My successor as coeditor for the physical sciences side of WRR is Steve Burges of the Department of Civil Engineering at the University of Washington in Seattle. He has read this article and on the reviewer appraisal form, he recommended 'publication with minor revision.' This response suggests either that our personal philosophies are not all that far apart or that this is the hydrologic equivalent of the Nixon pardon.

The editorial board of *Water Resources Research* consists of two coeditors and a slate of associate editors. During my tenure, I was fortunate to work first with Dave Major and then with Jerry Cohon as coeditor for the social sciences side of WRR. At various times, 25 different scientists (see box) served as associate editors, and all were involved in both the day-to-day processing of manuscripts and the long-term development of policy. They deserve a great deal of credit for the success of the journal.

*Coeditor, Water Resources Research, 1977–1980

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The hours they put in on behalf of the journal are long: the thanks they get is embarrassingly meager.

The WRR Editorial Process

The WRR editorial process is outlined in Figure 1. Authors submit their papers to one of the two coeditors, who in turn select an associate editor to process the paper. Associate editors are responsible for selecting reviewers and ensuring that reviews are completed within a reasonable time. After analyzing the reviews, the associate editor may return the paper directly to the editor, either for rejection or because no revisions are needed, or he may return it to the author for revision. Authors are instructed to send their revised manuscript back to the associate editor so that he can check to see that the requested revisions have been carried out. If so, the manuscript comes back to the editor and thence to AGU for publication. One copy of the typescript and the glossy prints of the figures are kept on file at the editor's office during the entire editorial process. Final notification of acceptance or rejection comes to the author from the editor's office. In rare instances, the editor may choose to reject a paper without sending it through the full review process.

Figure 1 also shows the range of elapsed times that one might expect for each step of the editorial process. The total processing time is controlled in large part by the time taken by reviewers during the review stage and by authors during the revision stage. With mailing times now running between ½ and 1½ weeks, even if reviewers and authors respond quickly, total processing time takes 2½ months. A more usual period would be 5 months; and if reviewers, authors, and the mails are all slow, the editorial process can take 8 months. Statistics kept by the AGU Publications Division confirm this analysis. In 1979, for example, 10% of the submissions were sent to AGU within 14 weeks and 50% within 28 weeks. There were 10% that took longer

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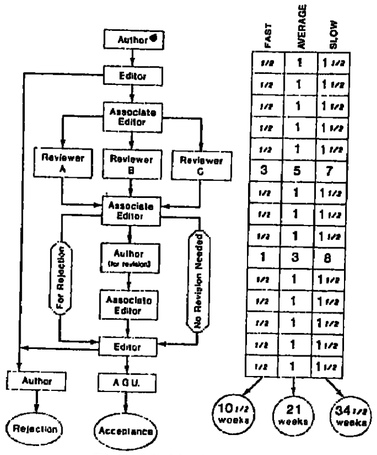

Fig. 1. Editorial review process.

than 1 year. An analysis by the editor's office of those manuscripts that took longer than 8 months to process revealed that 75% of the cases resulted from lengthy author revision periods. Of the remaining 25%, about half were the result of unavoidably lengthy or multiple interactions between author and associate editor on difficult or marginal papers, and about half can be chalked up to inefficiency on the part of the editorial board.

Once the papers go to AGU there is a further processing time of 5 to 8 months for copy editing and galley-proof preparation and review. The AGU Publications Division recently committed itself to improving its average performance from the 25–27-week average for 1979–81 to 20 weeks for 1981–82.

In summary, authors who do not take undue time with revisions should anticipate that the total time from submission to publication will run between 8 and 13 months. As this statement indicates, total processing time follows a statistical distribution with a fairly large standard deviation. Undoubtedly, most authors realize this, but the realization doesn't lessen the frustration of those authors whose papers seem to be progressing at a rate designed solely to satisfy the laws of statistics in the 95% tail.

It is clear that processing times could be reduced by a simplification of the scheme outlined in Figure 1. As Alex Dessler has pointed out for the blue JGR [*Dessler*, 1972], the editor could take on a greater role in the selection of reviewers or in making decisions without the aid of reviewers. This approach would minimize the role of the associate editors. In a field as diverse as water resources has become, I personally doubt whether an editor operating without heavy dependence on associate editors could properly maintain the quality of the journal. I think that the current system is a good one and that processing times are best minimized by administrative vigilance from the editor's office and constant pressure on authors and referees to review and revise quickly.

Reviews, Rejection, and Type II Errors

Gamesmanship, as Stephen Potter has made clear, pervades all of life. It should come as no surprise then to find that the reviewing process can be viewed as a game. As described by *Chambers and Herzberg* [1968]:

> Play opens with submission of the paper by the author. At this point the editor of the journal intervenes to select the opposing player(s). The next move is by the referee. Without loss of generality, we call this move the refusal. This may be followed by a further submission, a further refusal, and so on, until one or [the] other player concedes defeat.

Chambers and Herzberg then outline a series of tactics for the author and for the referee. Among those listed for the author is the 'Anticipation tactic:'

> Here the author attempts to disarm criticism either (a) by inserting flattering references to the work of all the more likely potential referees, or (b) by writing papers jointly with all the experts in the field, thus making it impossible to find a referee.

Among the tactics for the referee is the 'unsuitable-for-publication-in-this-journal tactic:'

> This tactic is also known as the 'shirking-of-duty tactic.' As a last resort the referee says that the paper is unsuitable for publication in the journal in question and makes a suggestion that it be submitted to another journal, which is suitably insulting to the author. This then ends the game between these two particular opponents. The referee then hopes that the suitably insulting journal does not ask him to referee the paper.

Apart from the obvious pleasures of gamesmanship, the purpose of the reviewing process is presumably twofold: (1) to provide authors with information to improve their presentation, and (2) to provide editors with information to aid them in their decision to accept or reject. Reviews may be positive or negative, and they may be useful or useless. A positive review recommends acceptance; a negative review recommends rejection. A useful review is one that provides helpful suggestions to the author in support of a positive recommendation or one that provides well-articulated documentation in support of a negative recommendation; a useless review is one that recommends acceptance or, worse yet, rejection, but provides no specific reasons.

If two or more reviews are received by the associate editor on a given paper, a unanimous recommendation for rejection or for acceptance, with or without revision, is usually accepted. In the case of mixed reviews, it has been WRR policy not to go out for a second round of reviews. A decision is made by the editorial board by implicitly assigning weights to the conflicting reviews and by exploiting the expertise of the board itself. Reviewers may vary widely in their suitability to the assigned review task. They may vary in technical competence, in scientific experience, in experience in the reviewing process, and in their known predilections for favorable or unfavorable response to the work of others. Reviewers must recognize that their reviews are recommendations only; the decision rests in the hands of the editors. Reviewers can be assured that all negative reviews are passed on to the authors, even if the negative recommendation has not been accepted. Once a decision has been reached to allow an author to revise his paper toward eventual publication, however, reviewers and editors alike must realize that it is the author's paper. If the author is going to have to lie in the bed, he ought to be allowed to make it.

> . . . some papers . . . are so original or so provocative that they deserve publication on these grounds alone. . . .

Editors, like statisticians, are subject to type I and type II errors. We occasionally reject papers we ought to publish; we occasionally publish papers we ought to reject. An editor's goal is simply to reduce the number of such occurrences to delta (which mathematics students will recall is always smaller than epsilon, which is itself very small). An unworthy acceptance is thought by most editors to be a much lesser evil than an unwarranted rejection. It is hoped that peer response will identify the incorrectly published paper in due course. The unfairly rejected material, on the other hand, may never appear, to the detriment of the author and the scientific community; or worse yet (in the eyes of the editor), it may be acclaimed after publication by the competition, to the detriment of the journal.

When a paper appears in WRR, no matter what you may think of it, it presumably received reviewer support from some quarter. The only exception is when the editor invokes what I like to call the Langbein doctrine. As Walter Langbein explained to me during his tenure as the first editor of WRR, there are some papers that are so original or so provocative that they deserve publication on those grounds alone, perhaps without review, or perhaps despite negative reviews. During my tenure, I invoked the Langbein doctrine on very few occasions and have not yet regretted any of those decisions.

During the period 1977–1980, the rejection rate for WRR ranged between 25% and 30% on first submissions. The effective rate is somewhat lower in that material originally rejected sometimes reappears in a totally revised resubmission that proves acceptable. The WRR rejection rate is in keeping with other AGU publications, with other earth science publications, and, indeed, across the broader spectrum of scientific journals in general. Much higher rejection rates are common in the humanities but not in the sciences.

Multiple-Part Papers

During my editorial tenure, I generally tried to avoid hard-and-fast policy rules, preferring instead a more flexible approach that allowed leeway for decisions on an individual basis. In this spirit I did not have a fixed policy about multiple-part papers. Papers that were submitted by authors in multiple parts were usually reviewed in that form. In cases where reviewers or editors felt that the readers would be better served by a single paper, authors were requested or instructed to carry out a major revision to that end. I did not have then, nor do I have now, any personal objection, either as an editor or a reader, to the appearance of multiple-part papers. I believe there are many scientific studies that are best reported in this form. I believe that decisions about format should be left in the author's hands, unless reviewers identify the format as a weakness in the presentation. Editorial decisions on multiple-part papers ought to rest entirely on the technical merits. Journal editors have no obligation to take into account how institutions treat multiple-part papers in their publish-or-perish assessment of individuals. On the one hand, then, authors should be allowed (although perhaps not encouraged) to separate their work into parts when there is good reason to do so; on the other hand, the editorial board must remain vigilant to discourage abuse.

I have seen no evidence to suggest that authors who submit their work to WRR are familiar with the LPU strategy outlined by *Broad* [1981] in a recent issue of *Science*. An LPU is the 'least publishable unit' of an ongoing research project, and Broad holds that the trickling forth of LPU's into the literature is in large part responsible for the massive explosion in journals, papers, and journal pages in recent years.

Page Charges

Many authors fail to submit good work to WRR because they feel that they would be unable to pay the page charges. This is a mistake; AGU recognizes that all scientists do not enjoy sufficient support to pay page charges, and it is AGU policy that all accepted papers are published in WRR, regardless of whether the page charges are honored. In this sense, WRR page charges are voluntary. Having said this, I must emphasize that the financial health of WRR is dependent on the payment of page charges by those with sufficient research support. It is an abrogation of scientific responsibility if available grant funds are diverted to other purposes while page charges go unpaid.

> The editorial process is carried out independently of the page charge decision. . . .

Correspondence about page charges takes place directly between the author and AGU. The editorial process is carried out independently of the page charge decision; in fact, without knowledge of it.

If the percentage of unpaid pages in WRR were to become very large, AGU reserves the right to offer priority publication to papers on which the page charges have been paid and to delay those on which the page charges have not been paid. During my 4 years as editor, however, there was no delay at any time in the publication schedule of any paper, and there is currently no such delay.

Theory and Practice

Apparently the hydrologic community carries two strong perceptions about WRR. First, it is perceived as the leading journal in the field; and second, it is thought to favor theoretical papers at the expense of applied papers. As editor, I was always pleased with the first view, less so with the second.

As noted on the inside front cover of the journal, 'the editors of WRR invite original contributions in hydrology.' Clearly, 'original contributions' may come in the form of improvements to scientific theory and methodology, or they may come in the form of advancements to engineering practice and policy analysis. I have occasionally noticed that authors who publish the theoretical derivation of a new methodology in WRR will publish its initial application in another journal. This may be done simply to gain a wider readership; but if it is done with the thought that WRR would not be interested in the practical paper, then that perception is incorrect. The journal is very interested in publishing papers that emphasize field applications, engineering design, instrument development, or policy analysis. The fact that there are relatively few such papers reflects upon lower submission rates, not upon higher rejection rates. It is not necessary that a paper have a strong mathematical component. The editors would like to see more papers that report the results of careful field measurement programs, especially ones that lead to an original or creative hydrologic message.

The type of applied or practical paper that is not likely to be accepted is one that utilizes a well-known technique in a field application that has no particular uniqueness. (Of course, theoretical papers of this type are not likely to be accepted either). This is not to say that papers of this type are not useful to the water resources community. The purpose of such papers, which is to build up documentation of engineering precedent and case histories of policy analysis, is a valid one, but WRR has chosen not be the outlet for this type of work.

One last comment: while the perception of WRR as a theoretical journal has some basis in fact, the reality is not nearly as clear as the perception. Any reader who thumbs through the issues of the past few years, will find a healthy percentage of papers that emphasize field measurements and practical applications.

Sociology of the Reviewing Process

The most fundamental question that can be asked about all this is: 'Is the review process really necessary?' A negative response would probably be treading on the rather thin line that exists between the review process and censorship, and on the question of bias.

Surprisingly perhaps, there has been a good deal of sociological study of these questions. Ever since Derek de Solla Price first turned the methods of science on science itself [*Price*, 1963], there have been numerous statistical studies designed to measure the efficiency of the review process in terms of its stated goals and to uncover evidence of bias. Most of the studies have used the physics literature as their statistical sample, but I expect that their conclusions can be carried over to the earth sciences.

With regard to the bias question, *Gordon* [1979] discovered statistically significant relationships between referees' evaluations and the national and institutional affiliations of the referee-author pairings. For example, reviewers from 'major' universities were harder on authors from 'minor' universities than on those from major universities. In this case, of course, there may be a deterministic as well as a stochastic component to the finding. Less easily dismissed is his evidence that British referees provided more favorable reviews of British authors than of North American authors, and vice versa.

> . . . it is every editor's prerogative to judge for himself the balance point he wishes to occupy on the tightrope. . . .

Zuckerman and Merton [1971] report more encouraging results with respect to bias. They investigated the effect of the relative ranks of author and referee on the referee's decision. The first rank was a small group of award-winning physicists; the second rank was a larger group, whose biographies were widely available in scientific who's-who listings; and the third rank was the very large group that didn't qualify for either of the first two ranks. Six possible forms of bias were investigated. If authors outrank referees, either status deference or status envy could be important. If referees outrank authors, bias might take the form of status patronage or status subordination. If author and referee come from the same rank, the referee could feel status competition or status solidarity. The statistical studies did not lead to the acceptance of any of these six hypotheses.

Zuckerman and Merton did uncover a correlation between rank and acceptance rate but not between age and acceptance rate. In fact, 'the youngest group of third-rank physicists had as high an acceptance rate as the oldest group of high-rank physicists whose work, we suppose is no longer as good as it once was.' Zuckerman and Merton concluded that the reviewing system apparently does exactly what it is supposed to do, sift out the good papers from the bad.

The question of censorship must surely stand or fall on whether partisan judgements or harsh reviews have created (in the words of *Ziman* [1968]) 'a hidden treasure of rejected works of genius which would have revolutionized our view of Nature had they been published.' Ziman thinks not, and I think not, too. I agree with *Manheim* [1973] and *Broad* [1981] that a more likely cause for the failure of a good idea to take root would be its burial in the flood of publication that overwhelms scientists every day. Manheim makes the case for higher journal standards as a protection against this flood. I suppose it is every editor's prerogative to judge for himself the balance point he wishes to occupy on the tightrope between the maintenance of journal standards on the one hand and the reduction of type I errors on the other.

Lastly, there is the question of whether a review system that manages to reject only one quarter of its submissions is superfluous on that ground alone. This view neglects the fact that the remaining 75% may be strengthened. In addition, as Zuckerman and Merton have noted, the very existence of a reviewing system serves as a form of quality control. Knowing that their papers will be reviewed, authors take care in preparing them, and often the journal's high standards become their own.

Acknowledgments

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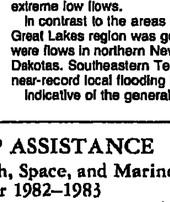

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Forum

Re: Magnetic Monopoles

It might be of some interest to note that following Vestine's suggestion, we had incorporated the magnetic monopole (g_M^0) as a variable in our geomagnetic field modeling programs several years ago and sometimes turn it on (allow it to assume a nonzero value) to help test our analyses. As we reported at the Bergen meeting in 1966, its value tends to hover about the level which we guess to be the accuracy of the coefficients desired and has been as low as 1 nT from the models run using only POGO data.

We have also tested using the recent Magsat data and find g_M^0 now about 3 nT for the earth. Ignoring the real possibility that we are only determining a noise figure, is there a chance that the sum of all monopoles in the earth could add up to an observable g_M^0?

Joseph C. Cain
Branch of Electromagnetism and Geomagnetism
U.S. Geological Survey
Denver, Colo

News

Update: Mt. St. Helens

Mt. St. Helens Volcano, Cascade Range, southern Washington, USA (46.20°N, 122.18°W). All times are local (GMT–7). Increases in the rate of deformation within the crater, SO_2 emission, and seismicity preceded the extrusion of a new lobe onto the northeast portion of the composite lava dome in early September. For the first time, weather conditions allowed observation of the crater immediately before, during, and after an extrusion episode.

Beginning September 2, U.S. Geological Survey (USGS) personnel working in the crater noted one to two rockfalls per hour and frequent audible and felt earthquakes. However, the earthquakes were probably very shallow, as no significant increase in seismicity was recorded by the University of Washington seismic net through September 4. Audible and felt earthquakes in the crater were nearly constant on September 5, and rockfalls increased further, particularly from the overhanging northeastern portion of the June lobe. Recorded seismicity began to increase shortly after noon and increased more rapidly during the predawn hours of September 6, triggering a joint USGS-University of Washington advisory at 0800 September 6 that predicted a dome-building eruption within the next 12–48 hours.

During this period, sharply varying data were returned by the three continuously recording bubble tiltmeters that had been installed in a roughly N-S line within 150 m of the east side of the composite dome in early July. After recording about 80 μrad/day of inflation between September 1 and 4, till at the northern instrument reversed to relatively slow deflation on September 5. Deflation continued on this instrument until its telemetry was ended by a rockfall during the afternoon of September 6. No reversal of inflation occurred at the central tiltmeter, about 175 m SE, where inflation had accelerated through July and August and had reached a rate of 700 μrad/h on the morning of September 6. This instrument recorded more than 10,000 μrad of inflation on the 6th before an incandescent boulder ended its telemetry during the afternoon. The southern tiltmeter (about 300 m SW of the central instrument) had recorded no significant tilt previously, but began to show deflation September 5 that continued through the 8th. The variation in the data recorded by these three instruments, combined with substantial differences in the rates of thrust fault movement around the dome, indicated to USGS personnel that the crater floor was behaving as a group of independent blocks or plates on a scale of the order of 100 m rather than as a single relatively coherent body.

The seismicity changed character to lower-frequency events with emergent arrivals after dawn on September 6. About 1000 avalanche events began to dominate the seismic record, with only a few discrete low-frequency events appearing for the next several hours. USGS personnel working in the crater observed huge blocks falling from the northeast portion of the June lobe and were soon forced to retreat to a ridge north of the crater. On the seismic record, avalanche events peaked about noon but remained at high levels until about 1700. Clouds of dust from the frequent rockfalls made observation of the crater difficult, but by 1500–1530 it was evident to USGS personnel that the entire northeast portion of the June lobe was breaking up. A bulge appeared to be developing on the east side of the lobe, but poor viewing conditions made this observation uncertain. By 1600–1700, an area of tens of square meters of fresh lava was clearly visible on the dome, and by 1830, many glowing rockfalls could be seen; some of the falling material appeared to be liquid. The number of seismic events began to decline after 1700. Significant numbers of low-frequency events resumed briefly about 2200, but seismicity dropped sharply at about 2330.

Aircraft crews monitoring the crater during the night of September 6–7 saw numerous glowing rockfalls. By 0500 on September 7 a new lobe was clearly visible in the area formerly occupied by the northeast portion of the June lobe. Most of the northeast portion of the June lobe had fallen as talus, but from its high point to the SW, the June lobe remained intact. Slow seismic growth and downslope spread of the new lobe were continuing as of September 9. USGS field parties reported that the new lobe was clearly larger and extended farther downslope on September 10 than on the previous day and had grown to roughly the size of the lobes extruded in previous episodes. Precise determination of the volume of the new lobe and its daily growth rate await analysis of airphotos and reduction of field data.

Information contacts: Tom Casadevall, Dan Dzurisin, and Christina Heliker, USGS Field Office, 301 E. McLaughlin, Vancouver, Washington 98663; Christina Boyko, Steven Malone, Elliot Endo, and Craig Weaver, Graduate Program in Geophysics, University of Washington, Seattle, Washington 98195; Robert Tilling, USGS, Stop 906, National Center, Reston, Virginia 22092.

Nation's Water OK Despite Dry Spots

Streamflow conditions across the United States improved somewhat during August, with more areas reporting normal flows than in previous months, according to a month-end check by the U.S. Geological Survey.

USGS hydrologists said that areas of low flow conditions persisted in much of the West and stretched across the Southeast from Virginia south to Florida and west to Louisiana. A small area of New York and most of Connecticut and Rhode Island were also well below normal—within the lowest 25% of record; that is, 75% of the time, streamflow will equal or exceed the measured levels.

About one third of the 164 key index stations reporting in August showed well below normal streamflow in parts of 24 states. The low flow conditions are relatively unchanged from those reported last month, when 23 states reported extreme low flows.

In contrast to the areas of low flow, streamflow in the Great Lakes region was generally well above normal, as were flows in northern New England and portions of the Dakotas. Southeastern Texas reported high flows and near-record local flooding in some areas.

Indicative of the generally good conditions in much of the

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AGU is again participating in the American Geological Institute's Minority Participation Program of Scholarship Assistance. Matching funds from a NOAA sea grant have also been requested, and funding may be available specifically for marine science students. To qualify, applicants must be the following:

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Washington, D.C. 20009
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For application forms, write to:

William H. Mathews III
Director of Education
American Geological Institute
Box 10031, Lamar University Station
Beaumont, Texas 77710

DEADLINE FOR RECEIPT OF COMPLETED APPLICATIONS IS FEBRUARY 1, 1982.

country, the combined flow of the nation's 'Big Five' rivers (Mississippi, St. Lawrence, Columbia, Ohio, and Missouri) averaged 690 billion gallons a day during August, 31% above normal. August marks the third straight month of above-normal flow of the Big Five, after 6 straight months of below-normal conditions. The Big Five, which account for stream runoff in about half of the conterminous United States, provide a quick check on the pulse of the nation's water resources. (Photo credit: U.S. Geological Survey, Department of the Interior.)

Linking Star Age and Rotation

As a star ages, it rotates more and more slowly. Astronomers believe that stellar winds (escaping gases that carry trapped magnetic fields to great distances) are the cause: they gradually drain the star of its inborn rotational momentum. Also, with increasing age a star's magnetic activity declines. Are the two phenomena—slowing rotation and decreasing magnetic activity—related? Arthur H. Vaughan of the Mount Wilson and Las Campanas observatories reports evidence that rotation of stars similar to the sun varies with their observed magnetic behavior.

Vaughan and his coworkers developed a new method for measuring how rapidly stars rotate. Relatively little had been known about the rotational rates of stars like the sun because their rotation speeds are often too small to measure by classical spectroscopic means. The method, to be described in the November *Astrophysical Journal*, is an adaptation of work done since 1966 by Olin C. Wilson at the Mount Wilson Observatory.

In most ordinary stars, dark 'spots,' corresponding to sunspots, would be imperceptible. However, it is known from the sun that such spots or groups of spots are accompanied by intense emission of light at two particular wavelengths visible through the earth's atmosphere: the H and K lines of ionized calcium. By measuring the strength of these emission lines, Vaughan's group was able to study stellar magnetism and to detect effects of rotation. From these measurements springs new evidence linking stellar rotation rates and magnetic intensities.

Vaughan's group found that among stars of a given spectral type (or surface temperature, stellar radius, or mass), the faster the rotation, the greater the average level of a star's magnetic activity. They base their work on 100 consecutive all-night observations of 54 stars.

Reduced Rates for AIP Journals

The American Institute of Physics (AIP) offers reduced-rate subscriptions of its journals to individual members of affiliated societies, including AGU. The offer is limited to one subscription per person to each journal.

Rates for 1982 for AGU members are given below:

	U.S. Member	Non-U.S. Member
Journal of Applied Physics	$50.00	$70.00
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To take advantage of this discount service, AGU members should send subscription orders, remittances, and a statement indicating membership status to AIP, 335 East 45th St., New York, NY 10017.

New Publications

Petrology and Genesis of Leucite-Bearing Rocks

A. K. Gupta and K. Yagi, *Minerals and Rocks*, vol. 14, Springer-Verlag, New York, 252 pp., 1980, $39.00.

Reviewed by D. M. Francis

In the preface, the authors state the need for a 'review-synthesis' of the data available on high-potassium volcanic associations. As a review, their book is a valuable source for information and references concerning this unusual, but wide spread, class of volcanic rocks. It is particularly useful as a collection of representative whole rock analyses and experimental results of relevant phase equilibria studies. As a synthesis, however, this book leaves much to be desired. The authors have chosen to paraphrase or quote the works of others, adding little in the way of comparison, evaluation, or interpretation of the results of these works. The job of distillation and synthesis is left to the reader. This is a problem that runs throughout the book. In the chapter on nomenclature, they begin well by advocating the use of standard rock names such as basanite and tephrite with mineral modifiers (i.e., leucite basanite). They rapidly descend, however, into the bizarre alkaline world of jumillites, arendites, etc., making little attempt to clean up this legacy of a parochial age in geology. In the chapter describing individual localities, the authors again paraphrase original reports so that one wonders about the relationships between such 'creatures' as the fitzroyites of Australia and the wyomingites of their namesake. Frequently, different chemical or mineralogical plots (after the original reports) are employed for different occurrences. It is the reader who must sift through the actual whole rock analyses in an effort to compare and contrast the individual volcanic suites. This work should have been done by the authors, both in the text and through the use of common chemical plots.

The final chapter on possible origins of highly potassic magmas is the only one in which the authors attempt a critical evaluation rather than a precis of the results and hypotheses of previous studies. In doing so, however, they devote an inordinate amount of attention to old, out of date ideas and very little attention to developing the preferred model involving the melting of a phlogopite-rich mantle source. Much could have been discussed in relation to this hypothesis, including mantle metasomatism, implications of the relative stabilities of mica and amphibole, the possible involvement of the low velocity zone, tectonic significance, etc., but was not! To say simply that potassium-rich magmas are generated from potassium-rich mantle only transfers the problem.

From a technical point of view, I am concerned about the treatment of the chemistry of these rocks. There is no section that discusses their major element compositions and resultant implications. This inattention gets the authors into difficulty when they infer, from experimental results on simple systems, that tephrite will fractionate to basanite. Inspection of relevant real whole rock analyses indicates that the reverse must be the case. The chapter on mineralogy gives compositional data in weight percent with no conversion to formula notation. Without this, the extent and significance of mineral solid solution cannot be appreciated. The chapter on trace elements and isotopic data is also inadequate. Trace element data are simply listed (many of which are dated) with no discussion of the behavior and implications of characteristic groups such as LIL elements, high field strength elements, and highly compatible elements. Similarly, there is little discussion of the significance of the isotopic data given for these rocks.

In summary, this book has value as a compilation under one cover of much of the data available on highly potassic volcanic rocks. It is essentially, however, a book of lists. Unfortunately, the authors have missed the opportunity, which this type of format provides, to contribute a comprehensive synthesis of the state of knowledge on this type of volcanism. It is indicative of the book as a whole, I think, that no statement of current problems nor suggestions for directions of future research are made. Opinions are required of experts as well as facts!

D. M. Francis is with the Department of Geology, McGill University, Montreal, Quebec, Canada.

New Listings

Items listed in New Publications can be ordered directly from the publisher; they are not available through AGU.

Minerals from the Marine Environment, Sir Peter Kent, John Wiley, New York, viii + 88 pp., 1981, $13.95.

The Ocean Basins and Margins, vol. 5, *The Arctic Ocean*, A. E. Nalm, M. Churkin, Jr., and F. G. Stehli (Eds.), Plenum, New York, xiv + 672 pp., 1981, $55.00.

Paleoecology, Concepts and Applications, J. R. Dodd and R. J. Stanton, Jr., John Wiley, New York, xiv + 559 pp., 1981, $39.95.

Pollution Pricing: Industrial Response to Wastewater Charges, J. F. Hudson, E. E. Lake, and D. S. Grossman, Lexington Books, Lexington, Mass. xix + 213 pp., 1981, $23.95.

Precambrian Plate Tectonics: Developments in Precambrian Geology, 4, A. Kröner (Ed.), Elsevier, New York, xxi + 781 pp., 1981, $185.25.

The Urban Climate, H. E. Landsberg, Academic, New York, x + 275 pp., 1981, $29.50.

The World Ocean: An Introduction to Oceanography, 2nd ed., W. A. Anikouchine and R. W. Sternberg, Prentice-Hall, Englewood Cliffs, N.J., xiii + 513 pp., 1981, $19.95.

Honor Your Colleagues

The Fellows Committee of AGU

This committee, under the chairmanship of Nicholas C. Mataias, is seeking nominations for Fellows of the Union. Nominees for fellowship should be *scientists who have attained acknowledged eminence in a branch of geophysics.*

Fellows' nominations must be made on forms available from the Member Programs Division, American Geophysical Union, 2000 Florida Avenue, N.W., Washington, D.C. 20009 (telephone: 202/462-6903 or toll free 800/424-2488).

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Arizona State University, Department of Chemistry. Visiting professor, 1982–83 academic year or part thereof. We seek a person or persons with established research programs in geochemistry, mineralogy, petrology, and/or solid state chemistry to teach advanced special topics course(s), interact with faculty and students, and pursue own research. May be an excellent sabbatical opportunity for established scientist. Contact: A. Navrotsky, Department of Chemistry, Arizona State University, Tempe, AZ 85281, (602) 965-4241.
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Director Geodetic Survey, NOAA. The National Oceanic and Atmospheric Administration (NOAA) announces a Senior Executive Service Vacancy for the position of Director, Geodetic Research and Development Laboratory (GRDL) in the National Geodetic Survey, a component of the National Ocean Survey. The duty location is Rockville, Maryland. The salary range is $47,889–$50,112.50 per annum. Duties include providing technical and administrative supervision over employees and activities of GRDL; advising officials on the state of scientific knowledge in geodesy and making recommendations for research and development; exercising scientific and technical knowledge of contributing publications to professional journals and making presentations at national and international meetings; and advising and consulting scientists and executives in improvement of geodesy and related fields. Experience in management of scientific programs, geodesy, and solid earth sciences is required. Apply to: NOAA/NOS-6001 Executive Boulevard, Rockville, Maryland 20852. Attn: MB/PER1:TR
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Research Associate in Geochemistry/University of Chicago. Post-doctoral position involving extraction of micro-samples from meteorites under clean conditions and analysis for major and trace elements by instrumental and radiochemical neutron activation. Goal is to investigate behavior of the elements during condensation of the solar system.
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City University of New York, (Brooklyn College) Faculty Positions. The Department of Geology anticipates filling several tenure track positions at Full Professor level. (Salary range up to $43,400). Highly qualified individuals will be considered for distinguished appointments at an additional $5,000.
While candidates who have distinguished themselves in any field are welcome to contact us, we are particularly interested in openings in: energy resources (coal/petroleum), exploration geophysics, environmental geology or hydrogeology; coastal sedimentology, economic geology.
Successful applicants will be required to institute an active research program, supervise Master's and Ph.D. theses. Nominations and applications with current vitae should be sent to: Dr. B. Bhattacharji, Chairman, Dept. of Geology, Brooklyn College of City University of New York, Brooklyn, New York 11210. Positions open until filled.
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University of New Orleans/Geophysicist. Applications are invited for a permanent faculty position commencing August 1982, in exploration geophysics. The Ph.D. or equivalent experience is required.
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Applicants should send a letter outlining interest in position, complete résumé, and three letters of recommendation to Dr. Gordon Frey, Department of Earth Sciences, Lake Front, University of New Orleans, New Orleans, LA 70122.
UNO is an equal opportunity/affirmative-action employer. Applications from minority groups are specifically invited.

Hydrogeologist. The State University of New York at Binghamton is re-opening its search for an assistant or associate professor of hydrogeology to join a department already active in several areas of water studies. The applicant should have a PhD and experience in mathematical techniques, as well as field experience. The applicant will be responsible for instruction at both the undergraduate and graduate levels and for developing a program of research. The position will be filled in September 1982.
Please send application, including the names of referees, to Thomas W. Donnelly, Chairman, Department of Geological Sciences, State University of New York, Binghamton, New York 13901.
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Geophysicist/Geologist: The University of Texas at Austin, Institute for Geophysics. Four research scientist positions are now available at the University of Texas Institute for Geophysics in the fields of marine geophysics, tectonics, seismic stratigraphy, seismic reflection techniques and data processing, ocean bottom seismometer (OBS) and other seismographic instrument design and development, earthquake seismology, and lunar and planetary seismology.
The Institute maintains a modern dockside facility at Galveston, Texas (Galveston Marine Geophysics Laboratory), where a new marine building will be built next year. There is also a component of the Institute based in Austin. The Institute has a modern computer facility for processing and analyzing geophysical data and will be obtaining a new VAX interactive computer system early next year. The Institute maintains two research vessels, the R/V IDA GREEN and the R/V FRED H. MOORE, which have capabilities for conducting marine geophysical surveys including the collection of magnetics, multifold seismic reflection data (48-channel), sonobuoy data, and OBS refraction and earthquake data. The two-ship capability offers the exciting opportunity to conduct two-ship seismic experiments. In addition, the Institute operates extensive seismographic networks in several Central American and Caribbean countries. The Institute maintains close ties with the staff and facilities of the Department of Geological Sciences, which include modern radiometric, isotope, and paleomagnetic laboratories.
A Ph.D. degree is required, preferable in Geology or Geophysics. Salaries are negotiable depending upon experience and qualifications. The person must have the ability and desire to work on group projects, conceive and initiate new projects, collect and reduce data, and publish the results. If you are interested in this excellent opportunity to pursue a challenging career in the forefront of geophysical research in an academic setting, please send your qualifications and references to:

Director
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Geophysical Fluid Dynamicist/Physical Oceanographer. Applications are solicited for a junior faculty position in ocean physics or dynamics to begin in the academic year 1982–83. Areas of interest to the Department include analytical, numerical and laboratory modeling of physical processes and phenomena in the sea.
Yale University is an equal opportunity/affirmative action employer and encourages women and members of minority groups to compete for this position. Curriculum vitae, publications, and the names of three or more referees should be sent by 31 December 1981 to: Robert B. Gordon, Chairman, Department of Geology and Geophysics, P.O. Box 6666, New Haven, CT 06511.

Yale University/Department of Geology and Geophysics. Applications are solicited for a faculty position in solid earth geophysics to begin in the academic year 1982–83. Areas of interest to the Department include seismology, exploration geophysics, mechanical and physical properties of rocks and minerals, geomagnetism, and tectonophysics.
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Curriculum vitae, publications and the names of three or more referees should be sent by 31 December 1981 to Robert B. Gordon, Chairman, Department of Geology and Geophysics, P.O. Box 6666, New Haven, CT 06511.

Petrologist: Northern Illinois University. Applications are invited for a tenure track position in igneous or metamorphic petrology at the assistant or associate professor level beginning either January, 1982 or August, 1982. A Ph.D. degree is required and post-doctoral research experience is preferred. The successful candidate will be expected to pursue an active research program, teach at the undergraduate and graduate level, and direct Masters and Ph.D. graduate research work. Facilities housed within the Department of Geology include a fully automated electron microprobe, SEM, solid-source and gas-source mass spectrometers, AA, XRD, and XRF. To receive full consideration, please send resume, statement of research interests, and the names of three references, by November 1, 1981, to Jonathan H. Berg, Search Committee Chairman, Department of Geology, Northern Illinois University, DeKalb, Illinois, 60115.
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Research Position in Chemical Oceanography. California Institute of Technology, Division of Geological and Planetary Sciences. The position of research fellow is being offered at Caltech for research in oceanography. Investigations of the isotopic composition of neodymium and rare earth abundances in sea water and sediments is now being carried forward. The mechanism of injection of REE into sea water will be studied. The differences in $^{143}Nd/^{144}Nd$ in various water masses [Piepgras *et al.*, Earth and Planet Sci. Lett. *45*, 223–238 and Piepgras and Wasserburg, Earth and Planet. Sci. Lett *50*, 128–138 (1980)] is now being carried forward as an exploratory venture in order to determine the origin and chemical behavior of REE in the ocean and the potential use of $^{143}Nd/^{144}Nd$ as a tracer. The laboratory facilities for sample preparation and analysis are fully functional and will be available. Applicants should have training in oceanography and a good perspective on general physical oceanographic models.
Send resume and references to Professor G. J. Wasserburg, Lunatic Asylum, California Institute of Technology, Pasadena, CA 91125.
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Research/Positions/Remote Sensing. Applications are invited for two research positions in the Department of Geological Sciences, University of Washington.
Research Assistant Professor to do research and teaching in geological remote sensing. Candidate is expected to have at least two years' experience beyond the Ph.D. and a demonstrated research record in the application of reflectance spectroscopy to the geology of planetary surfaces. Experience with instrument design, computer programming and digital image processing is also necessary.
Research associate to conduct research in remote sensing of vegetation and rock vegetation mixes. Candidate must have a Ph.D. in forestry or related science, and a strong background in computer programming and operation of digital image processing systems.
Submit vitae and names of three references to John B. Adams, Chairman, Dept. of Geological Sciences, AJ-20, University of Washington, Seattle, Washington 98195. Closing date is October 31, 1981.
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EARTH SCIENCES

The Lamont-Doherty Geological Observatory of Columbia University invites scientists interested in any field of the earth sciences to apply for the following fellowships: two postdoctoral fellowships, each awarded for a period of one year (extendable to two years in special instances) beginning in September 1982 with a stipend of $22,500 per annum. Completed applications are to be returned by January 15, 1982.
Application forms may be obtained by writing to the Director, Lamont-Doherty Geological Observatory, Palisades, New York 10964. Award announcements will be made February 28, 1982 or shortly thereafter.
The Observatory also welcomes applications from candidates for postdoctoral research associate positions in this discipline.

Senior Faculty Position/Meteorology. Applications and nominations are invited for a senior faculty position in meteorology, at the University of Utah. Eligible applicant will also be considered for chairperson of the department. Candidates must possess a Ph.D. in meteorology or a related discipline. Applicants should have teaching and research experience and be interested in participating in both the graduate and undergraduate programs. Applicants should submit curriculum vitae and names of three professional references to:

Dr. Jan Paegle
Search Committee
Department of Meteorology
University of Utah
Salt Lake City, Utah 84112

Deadline for applications November 30, 1981.
The University of Utah is an affirmative action/equal opportunity employer.

University of Kansas/Sedimentology/Structural Geology. The Department of Geology of the University of Kansas, Lawrence, Kansas seeks applicants for two tenure track appointments that will begin in the fall of 1982 or spring of 1983. Geologists who meet the requirements for these positions and who can begin work in January 1982, are also invited to apply. Duties include teaching in our introductory, undergraduate major, and graduate courses; supervising graduate student theses and dissertations; conducting original research; and providing service through administrative and professional activities. Appointment to either one of these positions is potentially at any academic rank, but one or the other or both will be filled at the assistant professor level. Applicants must have the Ph.D. in hand or expect to complete it by the end of the first year of employment at the University. Minimum salary at the assistant professor level is $23,000; salary for each position will be determined by rank and experience.
Position 1. *Sedimentology.* We will consider applicants in any branch of sedimentology, but those with interests in studying carbonate rocks, in diagenesis and sedimentary geochemistry, or in the relationships of sedimentation and tectonics are preferred. The applicant will be expected to cooperate with present faculty in offering courses at the undergraduate and graduate level that cover all aspects of the study of sedimentary rocks.
Position 2. *Structural Geology, Regional Tectonics, or Metamorphic Petrology.* The successful applicant will be expected to teach a basic undergraduate structural geology course, offer graduate courses or seminars in some areas listed above, plus cooperate with present faculty in offering other undergraduate or graduate courses in mineralogy, petrology, physical geology, or Precambrian geology. If no suitable candidates apply for this position, the department may recommend hiring two of the applicants for position 1.
In the event the top candidates are about equally qualified, preference will be given to applicants for one of the positions who have experience that will allow them to teach a modern course in petroleum and subsurface geology or to applicants who will participate in the Department's summer field geology teaching program.
Priority will be given to applications received by November 6, 1981. Applications will be accepted from qualified candidates until the positions are filled.
Applicants should send a letter of application, a resume, and names of three references to:

Anthony W. Walton
Department of Geology
The University of Kansas
Lawrence, Kansas 66045
(913) 864-4974

The letter of application should include a statement of current and planned research interests and of courses that the applicant feels qualified to teach.
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Princeton University
PLASMA PHYSICS LABORATORY

RESEARCH POSITION IN THEORETICAL AND NUMERICAL SPACE PLASMA PHYSICS

A research position is available immediately in the Theoretical Division of the Plasma Physics Laboratory, Princeton University, for one year with the possibility of renewal for a second year. Physicists with a Ph.D. degree or its equivalent or degrees in other relevant disciplines are encouraged to apply.

The position involves theoretical and numerical simulation studies on space plasma physics under the support of the National Science Foundation. Interaction with the members of the Laboratory engaged in fusion plasma physics is encouraged.

We offer salaries fully commensurate with your experience and a comprehensive benefit package including 24 days vacation per year.

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Attention: Mr. B. E. Pearson

An Equal Opportunity Employer M/F

Engineering Geologist/Geophysicist. The Department of Geological Sciences, University of Saskatchewan, has a vacant tenurable position in engineering geology/geophysics. Applicants should be qualified to teach undergraduate and graduate courses and to conduct research in engineering geology. A background in structural geology may be appropriate. Well-equipped facilities are available for research in rock mechanics, fluid flow through porous media, acoustic, and electrical properties of rocks, and permafrost. Good opportunities exist for joint research with qualifications and experience. Send applications, detailed personal resume including the names of at least three referees, and other supporting data to Dr. W.G.E. Caldwell, Head, Department of Geological Sciences, University of Saskatchewan, Saskatoon, Saskatchewan, S7N 0W0.

Please note: until November 15, 1981 consideration will be given only to applicants who are Canadians or landed immigrants, after that date all applications will be considered.

Postdoctoral Position: Hydrologist/Soil Physicist. Research related to subsurface radioactive wastes storage in unsaturated fractured rock; assessment and prediction of water and solute transport. Salary $20,000 to $24,000 depending on qualifications. Position available October 1, 1981. Send resumé, transcript, and reprints of major publications to Dr Daniel D Evans, Department of Hydrology and Water Resources, University of Arizona, Tucson, AZ 85721.

Equal opportunity affirmative action, title IX section 504 employer.

Faculty Position: Environmental Engineering. Beginning January or September 1982. The position requires undergraduate and graduate teaching and sponsored research activities in the areas of water quality control and water resources. An earned doctorate is required and at least one degree in civil engineering is preferred. Rank will be at the assistant professor level and salary will depend upon qualifications. Apply to. Dr. Lester A. Hoel, Chairman, Department of Civil Engineering, University of Virginia, Charlottesville, Virginia 22901.

An affirmative action/equal opportunity employer.

Department of Geology/Geography: Howard University. Applications are invited for tenure track position in geology beginning August 1981. Candidates should have PhD and strong background in mineralogy, petrology, and geophysics with industry experience desirable: will teach and advise at undergraduate level and help initiate graduate program in near future. Must have sensitivity to special problems Blacks face in entering field, and commitment to their greater representation. Applicants should send resume with references to Dr. David Schwartzman, Chairman, Dept Geology-Geography, Howard University, Washington, D C. 20059.

An equal opportunity/affirmative action employer.

Purdue University. The Department of Geosciences invites applications for a faculty position, starting January or July 1982, in the broad field of mineralogy-petrology-geochemistry. A Ph.D. is required and preference may be given to scientists with an established record of research. The Department has an automated electron microprobe, mass spectrometer and laboratory for stable isotope studies, full range of high temperature and high pressure equipment, including furnaces for controlled fO_2 experiments, as well as X-ray equipment. The successful applicant will be expected to participate in both the undergraduate teaching and graduate studies programs, as well as actively engage in research. Rank and salary are open but will be commensurate with qualifications.

Purdue University is a land grant, state supported institution committed to academic excellence, and is an equal opportunity/equal access employer. For further information please contact Dr. Henry O. A. Meyer, Dept of Geosciences, Purdue University, West Lafayette, IN 47907 (Tel. 317-494-3271).

Closing date for applications is November 10, 1981.

Staff Officer: Climate Board, National Research Council. The Climate Board of the National Research Council invites applications for a position as principal staff officer for a two-year review and assessment of the implications of increasing atmospheric carbon dioxide. The incumbent will organize meetings of the study committee and related groups, draft and edit reports, supervise clerical/administrative/financial matters, maintain liaison with federal government and international activities, assist in coordination of related National Research Council activities, and participate in support of other Climate Board activities as required.

Applicants should have a doctorate or equivalent in a physical or social science area related to the carbon dioxide issue; demonstrated organizational/managerial ability; proven ability to produce scientifically sound, fully documented, and clearly written papers on scientific and technical subjects; and ability to deal with interdisciplinary issues and multidisciplinary groups are desired, together with broad experience in scientific research or administration. The applicant's primary expertise may be either in physical sciences (e.g., meteorology, oceanography, chemistry) or in relevant social sciences (e.g., economics) with working familiarity with the other.

The appointment will be for an initial period of one year at a salary between $35,000 to $41,500, depending on qualifications and experience. It is expected that extension for a second year will be available. Applicants should send letters of application and resumes to Dr. John S. Perry, Climate Board (JH 404), National Academy of Sciences, 2101 Constitution Ave., N.W., Washington, D.C. 20418, or call (202) 389-6102.

An equal opportunity employer.

Geophysics Position. The Physics Department of the University of New Orleans invites applications for tenure track positions available January 1982 or August 1982. Rank and salary are to be commensurate with experience and training. Candidates with background in geophysics, acoustics or computational physics are especially encouraged to apply. The UNO departments of Earth Sciences and Physics are jointly developing programs and curricula to respond to the demand for graduates in geophysics in the local metropolitan area and in the south central U.S.

The successful applicant can expect collaborative research support from faculty active in signal processing and enhancement techniques and in inverse scattering analysis. Other areas of departmental research involve atomic, molecular, and solid state physics, cryogenic geophysics, hydrodynamics and computational physics. Applicants should send a résumé to Professor J. Murphy, Search Committee, Physics Department, University of New Orleans, New Orleans, LA 70148.

The University is an equal opportunity/affirmative action employer.

Virginia Polytechnic Institute and State University: Senior Research Associate. Interesting and abundant research and publishing opportunities, including new University-owned MDS-10 VIBROSEIS system, VAX 11/780 computer. Must have experience in theory and application of reflection seismology, and be interested in the application of reflection seismology to the solution of geologic problems.

Send resumes to: Dr. D. R. Wones, Department of Geological Sciences, Virginia Polytechnic Institute and State University, Blacksburg, VA 24061-0796.

The University is an equal opportunity/affirmative action employer.

Seismologist. The State University of New York at Binghamton has a vacancy for a seismologist at assistant professor level. Ph.D. degree holders with research interest in exploration seismology or earthquake seismology with solid theoretical background are welcome to apply.

The successful candidate is expected to teach courses in applied geophysics, time series analysis, wave propagation, etc. Ph.D. with 0 to 5 years of teaching, research and/or industrial experience is appropriate for the position. Salary negotiable and competitive with academic institutions. Position available September 1, 1982.

Please send resume and names of three references to Chairman, Geophysical Search Committee, Department of Geological Sciences, State University of New York at Binghamton, New York 13901.

We are an equal opportunity/affirmative action employer.

Director, Office of Programs and International Affairs. The Office of Research and Development, National Oceanic and Atmospheric Administration (NOAA), has announced the vacancy of Director, Office of Programs and International Activities, located in Rockville, Maryland. The Office of Research and Development is responsible for administering an integrated program of research, technology and advanced engineering development and transfer relating to the oceans, the Great Lakes, the U.S. coastal waters, the lower and upper atmosphere, and the solar and terrestrial environment to increase understanding of the environment and human impact thereon, and thus provide the scientific basis for improved services. The Director, Office of Programs and International Activities, oversees the coordinated development of policies, programs and budgets, and international activities within the Office of the Assistant Administrator for Research and Development. This is an exciting and challenging opportunity for an individual with demonstrated knowledge of (1) oceanographic, meteorological, environmental, physical and/or engineering sciences (including at least 24 semester hours in physical science and/or closely related engineering science at the college level or above), or (2) program analysis techniques and methods involving broad experience in scientific and technological programs related to the oceans or the atmosphere. A knowledge of U.S. policies on treaties and international multilateral and bilateral agreements is desirable.

SALARY: This position will be filled under the Senior Executive Service (SES). Salary could range from $47,889 to $50,112.50 per annum.

APPLICATION: Interested persons should send a U.S. Standard Form 171, Personal Qualifications Statement by October 9, 1981, to Mrs. Susan Cisar, Personnel Management Specialist, Office of Personnel, MB/PER11, NOAA, 6001 Executive Boulevard, Rockville, Maryland 20852.

The Department of Commerce, National Oceanic and Atmospheric Administration is an equal opportunity employer.

Faculty Positions: The University of Iowa. The Department of Physics and Astronomy anticipates one or two openings for tenure-track faculty in August 1982. One or more visiting professorships, at any rank, are also expected to be available. Preference will be given to candidates with research activity in the following experimental and theoretical areas: astronomy, astrophysics, atomic physics, condensed matter physics, elementary particle physics, nuclear physics, plasma physics, and space physics. The positions involve undergraduate and graduate teaching, guidance of research students, and personal research. Interested persons should send a résumé, a statement of research interests, and the names of three professional references to Search Committee, Department of Physics and Astronomy, The University of Iowa, Iowa City, IA 52242.

The University of Iowa is an equal opportunity/affirmative action employer.

SERVICES

Coal Deposits. If you are financing, planning, exploring, drilling, or digging in connection with any form of energy, you need this complete, up-to-date book about the world's coal deposits. Includes production and reserves for mines. Hardcover, 6 × 9 inches, 590 pages. Table of contents, drawings, index, references, 1980. $156. Tatsch Associates, Thunder Road, Sudbury, MA 01776, USA.

COURSES

MSA Amphiboles Short Course. The Mineralogical Society of America will sponsor a Short Course on Amphiboles and Other Hydrous Pyriboles at the Marydale Retreat Center in Erlanger, Kentucky, October 29 to November 1, 1981, before the MSA/GSA Annual Meeting in Cincinnati, Ohio. Instructional Staff will be:

- J. B. Thompson, Jr. (Harvard)—Polysomatism and polytypism in pyriboles
- F. C. Hawthorne (Manitoba)—Crystal chemistry of amphiboles
- S. Ghose (Univ. Washington)—Subsolidus reactions of amphiboles
- P. Robinson (Univ. Massachusetts)—Amphiboles of metamorphic rocks
- M. C. Gilbert (VPI)—Phase equilibria and amphiboles of igneous rocks
- D. R. Veblen (Johns Hopkins) (Convenor and Editor)—Wide-chain pyriboles
- T. Zoltai (Univ. Minnesota)—Mineralogy of amphibole asbestos
- M. Ross (USGS)—Geological occurrence of amphibole asbestos

Contact: MSA, 2000 Florida Avenue, N.W., Washington, D.C. 20009. Telephone: 202/462-6913.

Registration Deadline: October 1, 1981.

ANNOUNCEMENTS

53rd Annual Meeting, Seismological Society of America. Abstract deadline September 25 for 53rd Annual Meeting of Eastern Section, Seismological Society of America, Oct. 26–28, 1981, Milwaukee, WI. (R. W. Taylor, Univ. of Wisconsin-Milwaukee, Dept. of Geological Sciences, Milwaukee, WI 53201).

STUDENT OPPORTUNITIES

Earth Sciences Assistantships and Fellowships. Research assistantships and fellowships are available to graduate students in the earth sciences from the Columbia University Department of Geological Sciences. The awards cover tuition and fees, and provide a yearly stipend of between $6400 and $8180.

Research is carried out at affiliated institutions including the Lamont-Doherty Geological Observatory, the Goddard Institute for Space Studies, and the American Museum of Natural History. Research topics available to students reflect the interests of the more than 300 Ph.D.-level scientists at these institutions and span virtually every area of the earth sciences.

The department encourages applications from students with an undergraduate degree in any of the natural sciences or engineering. For additional information please contact Ms. Mia Leo, Department of Geological Sciences, Columbia University, Lamont-Doherty Geological Observatory, Palisades, New York, 10964.

Graduate Research Assistantships in Physical Oceanography. Opportunities for graduate study with Research assistantship available for students interested in M.S. or Ph.D. programs. A summer program with stipend is open to college juniors. Write: Douglas Caldwell, School of Oceanography, Oregon State University, Corvallis, OR 97331

Meetings

NATO Conference on Space Plasmas

During the week of April 21–26, 1981, a group of research physicists with a special interest in artificial particle beams as applied to space plasma studies met at a conference site at Geilo, in the mountains of central Norway. Major support was provided by NATO, and the meeting was the first of a new series known as NATO Advanced Research Institutes. The session format somewhat resembled the recent Chapman conferences held at Yosemite National Park. Sessions were held each morning, Tuesday through Saturday, and after a lunch and recreational break, continued in the afternoon and early evening, up to dinner hour. The attendance was limited to about 65 persons, who were encouraged to stay together for the entire conference period. The unique character of the meeting was the result of current interest in this very specialized topic, the international attendance, and the excellent accommodations at the Vestlia Høyfjellshotell. The conferees assembled in Oslo and traveled together by train on Monday, April 20, arriving at Geilo in about 4 hours. The fact that most participants remained for the entire week and the fact that the rather relaxed pace of the meeting gave ample time for discussion and interchange of ideas contributed much to its success.

The conference was organized by the Norwegian group which was headed by Bernt N. Maehlum of the Norwegian Defence Research Establishment and which is one of the groups active in the applications of particle beams to space research. The program committee consisted of B. N. Maehlum, C. Beghin, W. Bernstein, A. Johnstone, and J. R. Winckler. The subject matter was divided into major topics, with one or more 40-minute summary papers in each area, grouped as follows: accelerator experiments in space, accelerator experiments in laboratory, the theory of beam plasma interactions, natural beam plasma phenomena in near space, the neutralization of charged bodies in a plasma, and a final session of future plans, discussions, and recommendations. Each subject area beside the summary talks included various contributed papers and a summary discussion organized by the session leader.

In recent years, particle accelerators carried by space vehicles have provided a valuable supplement to passive diagnostic experiments in exploration of space plasmas. Already, at least 30 large sounding rockets have carried accelerators or other types of plasma injectors into the ionosphere, and small electron or ion injectors have been used on orbiting vehicles. Much interest centers around the large accelerators to be carried by the space shuttle with accompanying plasma diagnostic instrumentation. The central interest of the conference was the interaction of a particle beam with a background plasma. The beam plasma interaction is one of the oldest known phenomena in plasma physics and dates back to the work of Irving Langmuir. In the '50's and '60's the subject was studied by Bernstein (Ira), by Bohm and Gross, and by Vlasov and Landau in the USSR. When it was proposed to inject particle beams from space vehicles, there was much concern that plasma waves would dissipate the beam energy catastrophically and rapidly thermalize the beam particles. Although a completely catastrophic beam loss does not seem to occur in practice, nevertheless strong interactions have been observed.

Plasma and wave diagnostics were widely discussed from measurements made in very large vacuum facilities in Japan, in Europe and in the Johnson Space Center, USA, as well as from space vehicles. A particularly definitive experiment was reported by the Stenzel group at UCLA and was a very carefully scaled measurement of the transient development of the basic beam plasma interaction in a region below the BPD (beam plasma discharge) ignition threshold. The experiment was conducted in a moderate-size laboratory chamber and demonstrated how plasma waves rapidly convert to ion acoustic and finally to electromagnetic mode, which can then be observed at large distances from the source. Electromagnetic radiation has been observed at ground level during the injection of electron beams in Soviet 'Zarnitza' experiments, during the Franco-Soviet 'ARAKS' launchings, and during the U.S. 'ECHO' flights. Whistler mode and other waves have been observed in space near the beam-emitting vehicle and were actively discussed at Geilo.

One of the most dramatic interactions is the BPD discovered by Smullen and Getty in the U.S. and studied by Karchenko and Fainberg and others in the USSR and by Bernstein (W.) and many others in the U.S. Numerous papers at the conference described recent laboratory studies of the BPD, using for example the giant vacuum facilities at the Johnson Space Center (now closed because of budgetary problems) and a wide variety of instrumentation, including television, wave and particle detectors, and plasma diagnostics. It is recognized that the spectacularly bright luminosity which appears in the chamber experiments above a certain threshold has the same nature as the classic RF discharge in a neutral gas except that the intense fluctuating electric fields are generated by a collective mode instability in the beam plasma interaction instead of by an external RF source and that a substantial neutral population is needed for ignition. An example of a beam-plasma discharge is shown in the figure (see cover).

A number of papers analyzed rocket experiments for the presence of the BPD in the ionosphere. Some cases seem quite certain; others are contradictory. Whistler mode radiation measured during beam injection in space strongly resembled that seen in the laboratory during BPD. However, space environment has no walls, and the scaling parameters must be adjusted on a different basis than the laboratory. Despite an extensive body of previous laboratory research on the beam plasma subject accompanying the surge of interest in fusion plasmas, one was impressed at this conference that many facets of the situation have been studied and clarified, with the basic motivation coming from the space applications. At BPD ignition the original monoenergetic beam electrons are strongly thermalized but are also accelerated above the injected energy. The acceleration of particles by plasma instabilities, which obviously has important implications in space, also dates back to the work of Langmuir.

Another facet of the problem involved natural auroral beams and the accompanying instabilities in an attempt to understand the discrete particle spectra and other characteristics of the aurora. In one set of experiments, electron beam echoes were sought from double layers supposedly existing on auroral field lines.

Electron beams have been used extensively to probe laboratory plasmas, but at Geilo the analogous technique of using particle beams to probe the distant magnetosphere to investigate magnetic field morphology, electric fields, plasma interactions, strong pitch angle scattering, and particle energization near the equatorial plane was described. These experiments are technically difficult but give basic information about magnetospheric dynamics not obtainable by other means.

Vehicle charging during beam injection has been much discussed and was well summarized at the conference, using experiments both from rockets in the ionosphere and spacecraft in distant orbits. It is clear that during the case of electron beam injection the vehicle potential rises and the flow of return current carried by ambient plasma electrons can produce a discharge (not a BPD) with the production of light, heat, and plasma wave activity.

Positive ion and plasma beams have been injected in space from many experiments and were described in some detail, including the phenomenon of wave production and trapping in the region produced by the plasma injection.

An electron beam on the space shuttle is an essential component of the proposed 'Tether' system, in which a long conductor will be deployed in orbit. Many features of electron beam injection and vehicle potential changes are basic to the 'Tether' experiments.

The conference served a useful purpose in presenting a melange of laboratory and space plasma results, including wave, particle and plasma diagnostics, and detailed theory and, at least for the writer, provided a major clarification in understanding how beams interact with laboratory and space plasmas. A comprehensive proceedings of the conference will soon be published by Plenum Press. Bjørn Grandal of the Norwegian Defense Research Establishment will be the editor.

This meeting report was prepared by J. R. Winckler of the Tate Laboratory of Physics, University of Minnesota.

Nominations for Awards

November 15 is the deadline for nominations from the membership for AGU Fellows and December 15 for awards for 1982. Nominations for Fellows must be made on forms available from the AGU office. Nominations for medalists and awardees require only a letter of nomination and supporting material. The Bowie Medal, Ewing Medal, Horton Medal, and Macelwane Award committees are accepting nominations for 1982 at this time.

Conference on Scientific Ocean Drilling (COSOD)
Sponsored by JOIDES

ORGANIZATION AND COORDINATION OF PLANS FOR FUTURE SCIENTIFIC OCEAN DRILLING PROGRAMS

November 16–18, 1981, Austin, Texas
Convened by: COSOD Steering Committee, R. L. Larson, Chairman

Sessions Planned:

November 16, 17

Reports and workshop discussions on the relation of the following topics to ocean drilling:

1. Origin and Evolution of Oceanic Crust
2. Origin and Evolution of Marine Sedimentary Sequences
3. Tectonic Evolution of Continental Margins and Oceanic Crust
4. Causes of Long-Term Changes in the Atmosphere, Oceans, Cryosphere, Biosphere, and Magnetic Field
5. Tools, Techniques, and Associated Studies

November 18

General Discussion on Coordination of Existing and Planned Scientific Ocean Drilling Programs

The meeting will be open to the general scientific community, and there is no registration fee. The conference will begin at 9:00 AM on November 16 at the Joe C. Thompson Conference Center, Room 3-102, on the University of Texas campus. For hotel reservations and other travel arrangements, please contact Mercury Travel, 1333 New Hampshire Ave., N.W., Washington D C. 20036, phone (202) 296-7862.

Ocean Sciences: AGU/ASLO Joint Meeting

February 16–19, 1982
San Antonio, Texas
Convenor: W. D. Nowlin, Jr., (AGU) and R. W. Eppley (ASLO)

Abstract Deadline: November 10, 1981

Special Sessions *Additional special session

- Ocean Climate and Biological Productivity Connections
- Overview of Large Oceanographic Projects
- Biology and Physics of Gulf Stream Rings
- Relations Between Biology and Circulation in the Gulf of Mexico
- Geological Effects of Ocean Circulation
- Anthropogenic Inputs to the Ocean: Diverse Points of View
- Processes and Resources of the North Pacific Shelves
- Small Lake Limnology
- Marine and Freshwater Bioturbation
- Ocean-River Interaction: Sedimentation and Chemistry
- Particle Fluxes in the Water Column and Benthic Boundary Layer
- Relations Between Mesoscale Physical and Biological Processes
- Coastal Processes
- Biological and Physical Measurement Techniques
- Microscale Processes and Effects on Biota
- Physics and Biology of Ice Edges
- Physical, Chemical and Biological Processes in Large Lakes
- *SANDS (Shelf and Nearshore Dynamics of Sedimentation)

Call for papers published in *EOS*, June 23.

Changes

The complete Geophysical Year last appeared in the August 25 *Eos*.

Boldface type indicates meetings sponsored or cosponsored by AGU.

1983

June 13–15 **International Symposium on Gas Transfer at Water Surfaces,** *additional contact.* G. H. Jirka, School of Civil and Environmental Engineering, Cornell University, Hollister Hall, Ithaca, NY 14853.

New Listings

1981

Oct 12–13 Lake Restoration Technology Institute, Madison, Wis. Sponsor, University of Wisconsin-Extension. (F. Driscoll, Program Director, University of Wisconsin-Extension, Department of Engineering and Applied Science, 432 North Lake Street, Madison, WI 53706).

1982

May 17–22 Symposium on Remote Sensing and Mineral Exploration, Ottawa, Ontario, Canada. Sponsor, Committee on Space Research (COSPAR) of the International Committee of Scientific Unions (ICSU). (W. D. Carter, EROS Office, U.S.G.S. (MS 730), Reston, VA 22092.)

June 7–9 Fourth Canadian Symposium on Mining Surveying and Deformation Measurements, Banff, Alberta, Canada. Sponsors, Sheltech Canada, Surveying Engineering, University of Calgary. (F. B. Claridge, D. R. Piteau and Associates Ltd., Suite 300, 1615 10th Avenue S.W., Calgary, Alberta, Canada T3C OJ7.)

Sept. 13–16 45th Annual Meeting of the Meteoritical Society, St. Louis, Mo. (G. Crozaz, Washington University, Box 1105, St. Louis, MO 63130.)

GAP

Geomagnetism and Paleomagnetism

1545 Spatial variations attributed to sea floor spreading
THE GALAPAGOS AXIAL MAGNETIC ANOMALY: EVIDENCE FOR THE EMPEROR EVENT WITHIN THE BRUNHES AND FOR A TWO-LAYER MAGNETIC SOURCE
Douglas S. Wilson (Dept. of Geophysics, Stanford University, Stanford, CA 94305) and Richard N. Hey

The axial (Brunhes) magnetic anomaly over the Galapagos spreading center shows consistent short-wavelength anomalies that are not consistent with a uniformly magnetized layer. We interpret this anomaly to confirm the presence of the Emperor reversed event at 0.49 ± 0.05 mybp, with a duration about 0.01 m.y. Further, this anomaly is consistent with a two-layer magnetic source, with the lower layer having very broad transition zones, offset away from the axis from those of the upper layer by about 10 km.
Geophys. Res. Lett., Paper 1L1178

1560 General or miscellaneous
A COMPARISON OF THE MAGNETIC PROPERTIES OF SYNTHETIC TITANOMAGHEMITES AND SOME OCEANIC BASALTS
Bruce M. Moskowitz (Department of Geological and Geophysical Sciences, Princeton University, Princeton, N.J., 08544) Subir K. Banerjee

The variation of some magnetic properties of (1) synthetic titanomaghemites and (2) oceanic basalts from DSDP site 417D as a function of grain size and oxidation is presented. The synthesis of the initial titanomagnetite (x=.6) was carried out using controlled fugacity and self-buffering techniques. Single phase titanomaghemites were produced by heating the titanomagnetite in air at low temperatures (<350°C). The magnetic properties studied on the synthetic titanomaghemites (grain size ~1 μm) show the following variation with increasing degree of oxidation (0≤z≤.6): (1) Curie temperature (T_c) increases, (2) saturation magnetization (J_s) at room temperature increases, (3) J_s measured at 77°K decreases for z≤.3 and then increases for z>.3, (4) bulk and remanent coercivities (H_c and H_{cr}) increase initially slightly (z<.2) and then decrease at room temperature and 77°K, (5) susceptibility (χ_o) decreases for z≤.3 and then increases, (6) the magnetic viscosity acquisition and decay coefficients (S_a and S_d) increase and (7) the median destructive fields (MDF) for an anhysteretic remanent magnetization (ARM) and a viscous remanent magnetization (VRM) increase for z≤.3 and then decrease. The magnetic data also suggest that the synthetic titanomaghemites are pseudo-single domained (PSD) and with increasing degrees of oxidation these PSD grains become more SD-like. The basalt samples from site 417D are divided into fine grained pillow basalts and coarse grained massive flows. Most of the magnetic properties measured are distinctly different between these two groups. The magnetic data indicate that the domain state of these basalts are probably PSD. Although it is difficult to separate the effects of grain size and oxidation on the magnetic properties of these basalts, it appears that grain size effects predominate. A preliminary investigation of the magnetic viscosity of the synthetic and oceanic titanomaghemites suggest that a combination of thermally activated and diffusive magnetic viscosity is responsible for their viscous behavior. Finally, we will discuss the roles of grain size and oxidation variation in oceanic basalts and their separate and combined effects on their magnetic behavior.
J. Geophys. Res., Red, Paper 1B1336

Meteorology

3720 Climatology
CLIMATIC SIGNALS OF THE ANTARCTIC OCEAN
J.O.Fletcher(Environmental Research Laboratories, NOAA,325 Broadway Boulder CO 80303),U.Radok and R.Slutz

An analysis of the 120-year historical record of ship observations of surface temperatures and winds for the Pacific and Indian Oceans has revealed the existence of two distinct ocean-wide modes of variability.One of these has a time scale of a few years; its most pronounced regional expression is El Niño. The other has a time scale around 100 years. It takes the form of large-scale anomalies in both wind and sea surface temperature lasting several decades,followed by a rapid transition to persistent anomalies of the opposite sign. There is indirect evidence for this sequence over a much longer time span than the last 120 years.

A special feature,examined in this paper, is a tendency for the anomalies to develop first in high latitudes. In the southern hemisphere this suggests changes in the thermal forcing by Antarctica. A first test of this hypothesis is made using a six-year series of Australian weather charts which also provide continuous wind estimates for comparison with recent ship data.
J. Geophys. Res., Green, Paper 1C1279 9-3-81

3740 General circulation
COSMOGENIC $^{10}Be/^7Be$ AS A PROBE OF ATMOSPHERIC TRANSPORT PROCESSES.
G.M. Raisbeck and F. Yiou (Laboratoire René Bernas, Centre de Spectrométrie Nucléaire et de Spectrométrie de Masse, 91406 Orsay - France.
M. Fruneau, J.M. Loiseaux, M. Lieuvin, J.C. Ravel, Institut des Sciences Nucléaires, 38026 Grenoble - France.

Using accelerator spectrometry to measure ^{10}Be, the ratio of the cosmogenic isotopes $^{10}Be/^7Be$ has been determined in 5 stratospheric and 2 South Pole ground level air filters. It is argued that this ratio can be a very sensitive probe of the origin, residence time, and mixing patterns of different atmospheric air masses, and in particular for identifying incursions of stratospheric air into the troposphere. (^{10}Be - ^7Be ; Atmosphere).
Geophys. Res. Lett., Paper 1L1315

3740 General Circulation
AN ADVECTIVE MODEL FOR TWO DIMENSIONAL TRANSPORT OF STRATOSPHERIC TRACE SPECIES
James R. Holton (Dept. of Atmospheric Sciences, University of Washington, Seattle, Wash. 98195)

A parameterization of two-dimensional transport is developed for application to photochemical models of stratospheric trace species. It is shown that in a first approximation tracer transport in the meridional plane may be treated as an advective, rather than a diffusive, process. The mean meridional motion used in this advective model is a modified Eulerian mean which is a good approximation to a Lagrangian mean motion.

The potential of the proposed parameterization is demonstrated by a simple numerical experiment in which the equilibrium distribution is computed for a tracer with a uniform tropospheric source and a stratospheric sink proportional to the local mixing ratio. The resulting distribution is somewhat similar to the observed distribution of N_2O in the stratosphere.
J. Geophys. Res., Green, Paper 1C1368

3740 General circulation
THE EFFECT OF A GEOGRAPHICAL CLOUD DISTRIBUTION ON CLIMATE: A NUMERICAL EXPERIMENT WITH AN ATMOSPHERIC GENERAL CIRCULATION MODEL
V. P. Meleshko (Main Geophysical Observatory, Karbyshev Str. 7, 194018, Leningrad, USSR) and R. T. Wetherald

This study is an attempt to estimate the effect of a geographical distribution of clouds on climate. A method of determination of a three-dimensional cloud distribution is proposed. It is based on the solution of the inverse problem for the radiative transfer equation. By using climatic data on total cloud amount, temperature, mixing ratio of water vapor and satellite data on outgoing longwave radiation, the global distributions of high, middle and low clouds were computed for July. The derived vertical cloud extension is in fair agreement with available data on the frequency distribution of stratiform and cumulus clouds. The numerical experiments are carried out with an atmospheric general circulation model in which zonal and geographical cloud distributions are prescribed. The integrations are performed for 60 days with a GFDL model and the last 30 days are analyzed.

The geographical cloud distribution causes the increase of surface temperature over the continents by 2–4° and leads to a decrease of surface pressure there and an increase over the oceans. The largest changes in the surface pressure, up to ±12 mb, occur in the middle latitudes of both hemispheres. The largest differences in precipitation are observed in the Tropics, and over some coastal regions of North and South America. Arid areas in the subtropical belt become more pronounced in case of the geographical distribution of clouds. Estimates of the level of significance for precipitation and surface pressure changes reveal that they are statistically significant in some areas of the globe. (Cloud distribution, radiation, temperature, hydrology).
J. Geophys. Res., Green, Paper 1C1294

Particles and Fields—Interplanetary Space

5940 Shock waves
MONTE CARLO SIMULATION OF CHARGED PARTICLES UPSTREAM OF THE EARTH'S BOW SHOCK
Donald C. Ellison (Laboratory for High Energy Astrophysics, NASA Goddard Space Flight Center, Code 661, Greenbelt, MD 20771)

A Monte Carlo simulation of a plane, parallel shock is used to model the observations of 'diffuse' ions upstream of the earth's bow shock. Spectra from solar wind to high energies are calculated for various forms of the diffusion coefficient and escape and an upper limit to the efficiency obtained. A diffusion coefficient that increases faster than linearly with velocity and free escape upstream are inferred. The efficiency for production of energetic ions from the thermal pool suggests that astrophysical shocks are capable of accelerating ions directly without need of a distinct pre-energizing injection stage.
Geophys. Res. Lett., Paper 1L1078